AUTOMATIC SCREWFEEDER

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to a power screwdriver and, more particularly, to an automatic screwfeeder mechanism for attachment to a conventional hand drill.

[0002] A number of fastener installation tools have been adapted to sequentially install fasteners to a workpiece. Typically, the fasteners are interconnected to one another with a web which is subsequently discarded after the fastener has been installed. Unfortunately, the cost and availability of collated and interconnected fasteners is prohibitive to widespread use of such devices.

SUMMARY OF THE INVENTION

[0003] Accordingly, it is an object of the present invention to provide an automatic screwfeeder for use with a conventional hand drill that does not require collated fasteners.

[0004] It is another object of the present invention to provide an automatic screwfeeder including a substantially translucent access cover to allow an operator to view fed fasteners and clear jams should they occur.

[0005] It is another object of the present invention to provide an automatic screwfeeder having a body axially moveable relative to a sliding core where the body includes a camming surface selectively engageable with a toggle. The toggle is adapted to retain fasteners in a pre-staged area and allow

individual fasteners to enter a staging area once the previously staged fastener has been driven.

[0006] It is another object of the present invention to provide a fastener engaging device such that an operator must input a predetermined load greater than the weight of the automatic screwfeeder to begin driving a fastener. This feature assures that inadvertent screw feeding and/or driving does not occur.

[0007] It is another object of the present invention to provide an automatic screwfeeder having a front assembly separable from a rear assembly. A driving bit is rotatably supported on the front assembly and may be replaced by disconnecting the front and rear assemblies.

[0008] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0010] Figure 1 is a fragmentary perspective view of an exemplary hand drill coupled to an automatic screwfeeder of the present invention;

[0011] Figure 2 is a partial exploded perspective view of a front assembly of the automatic screwfeeder of the present invention;

[0012] Figure 3 is a fragmentary exploded perspective view of a rear assembly of the automatic screwfeeder of the present invention;

[0013] Figure 4 is a fragmentary cross-sectional side view of the automatic screwfeeder of the present invention;

[0014] Figure 5 is a top view of the automatic screwfeeder of the present invention;

[0015] Figure 6 is a fragmentary perspective view of the front assembly of the automatic screwfeeder of the present invention;

[0016] Figures 7-10 are partial cross-sectional side views depicted non-actuated positions of the automatic screwfeeder of the present invention; and

[0017] Figure 11 is an exploded perspective view of the filter of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0019] Referring to Figures 1-3, an automatic screwfeeder 10 is shown coupled to an exemplary hand drill 12. Hand drill 12 is drivingly engageable with screwfeeder 10 to transfer torque to a bit 14. Screwfeeder 10 is operable to consecutively drive non-collated screws 16 (Figure 7) into a workpiece such as a floor without requiring the operator to manually feed each fastener to be installed.

[0020] Screwfeeder 10 includes a sliding core 18, a body 20, a screw accumulation tube 22, an extension tube 24, a drive mechanism 26 and a feeder mechanism 28. Body 20 and sliding core 18 form a front assembly 30 which is separable from a rear assembly 32. Rear assembly 32 includes screw accumulation tube 22, extension tube 24, and a pair of clamps 34 interconnecting extension tube 24 and screw accumulation tube 22. A nut 36 is rotatably captured on the end of extension tube 24. Nut 36 is threadingly engagable with body 20 to couple front assembly 30 to rear assembly 32. Rear assembly 32 and front assembly 30 are separated from one another to replace bit 14.

[0021] A driveshaft 37 is rotatably supported within extension tube 24 by a pair of bushing assemblies 38. Driveshaft 37 includes a hexagonally shaped first end 39 which is selectively engageble by an output member of hand drill 12. Driveshaft 37 includes a second end 40 which is also hexagonally shaped. Second end 40 is drivingly engaged with a coupling 42. Coupling 42 drivingly interconnects driveshaft 37 and bit 14. A handle 44 is coupled to extension tube 24 to assist an operator in applying an axial force to automatic screwfeeder 10 during a screw driving operation.

[0022] Screw accumulation tube 22 includes a first end 45 and a second end 46. Second end 46 is coupled to sliding core 18 by a grommet 47. Grommet 47 includes a substantially cylindrical body 48 having an aperture 50 axially extending therethrough. A plurality of ribs 52 radially extend from an outer surface 53 of body 48. An enlarged head 54 is positioned at one end of grommet 47. Head 54 defines an annular surface 56 which engages an end face 58 of

sliding core 18. Specifically, sliding core 18 is bifurcated to include a first housing portion 60 spaced apart from a second housing portion 62. First housing portion 60 defines a screw feed track 64. Second housing portion 62 defines a portion of a bore 66. First housing portion 60 includes a plurality of recesses 68 for receipt of ribs 52. Screw feed track 64 intersects bit bore 66 at nose cavity 70. Preferably, second end 46 of screw accumulation tube 22 is press fit within grommet 47 to interconnect screw accumulation tube 22 and sliding core 18.

[0023] A filter 72 is coupled to first end 45 of screw accumulation tube 22. Filter 72 is a two-part assembly coupled to screw accumulation tube 22 via fasteners 73. As best shown in Figure 11, filter 72 includes a plurality of ribs 74 including apertures 76 extending therethrough. Apertures 76 are offset from one another to define a serpentine path for screws 16 to follow. This serpentine path functions to greatly increase the difficulty of insertion of a screw head first instead of in the proper direction of tip first. Additionally, ribs 74 resist backflow of screws 16 if an operator should invert screwfeeder 10 to a position where gravity forces the screws toward filter 72.

[0024] Sliding core 18 is axially movable relative to body 20 between a collapsed position shown in Figure 4 and an extended position shown in Figure 7. To accommodate the relative motion of the components, clamps 34 include supports 77 which are coupled to screw accumulation tube 22 in a slip-fit manner. Accordingly, screw accumulation tube 22 axially translates with sliding core 18 and moves relative to extension tube 24 and body 20.

[0025] A panel 78 is slidably positioned between sliding core 18 and body 20. Panel 78 translates during movement of sliding core 18 to assure that an additional opening is not formed in front assembly 30 during operation. When sliding core 18 is in the extended position, a lip 79 (Figure 7) of panel 78 engages an upturned portion of sliding core 18 to properly position panel 78.

[0026] Body 20 of front assembly 30 includes a first half 80 and a second half 82. Both first half 80 and second half 82 are preferably constructed as injection molded shells which are substantially similar to one another. First half 80 is coupled to second half 82 via a plurality of screws (not shown). Body 20 is divided into a forward compartment 84 and a rearward compartment 86 by a bulk head 88. Bulk head 88 includes provisions for retaining certain components of drive mechanism 26.

[0027] Drive mechanism 26 includes bit 14, a sleeve 90, a return spring 92, a retaining clip 94, coupling 42 and driveshaft 37. Return spring 92 circumscribes sleeve 90 and is positioned within forward compartment 86 to bias sliding core 18 away from body 20 toward the extended position. As shown in Figure 2, body 20 includes a plurality of rectangular protrusions 100 selectively engageable with sliding core 18 to limit the travel of body 20 relative to sliding core 18.

[0028] Sleeve 90 includes a first end 104 having a flange 106 which is retained within slots formed in first half 80 and second half 82. A second end 108 of sleeve 90 and a portion of return spring 92 are slidingly supported by sliding core 18.

[0029] Bit 14 includes a first end 110 and a second end 112. First end 110 includes a tip 114 selectively engageable with the head of the fastener 16. Second end 112 includes a hexagonal section 116 which is drivingly coupled to driveshaft 37 positioned within extension tube 24. Bit 14 is positioned within sleeve 90 and retained therein by retaining clip 94. Driveshaft 37 provides torque to bit 14 via coupling 42. Retaining clip 94 restrains bit 14 from axially moving relative to sleeve 90 but allows rotational movement relative thereto. Based on the interconnections previously described, it should be appreciated that sleeve 90 and bit 14 axially translate with body 20 during operation.

[0030] As best shown in Figures 4 and 7, a detent spring 117 includes an arm portion 118 and an upset portion 120. Arm portion 118 is cantilever mounted to body 20. Detent spring 117 functions to require an operator of automatic screwfeeder 10 to purposely input a force greater than the weight of the screwfeeder to move body 20 and sliding core 18 toward the collapsed position. Incorporation of detent spring 117 assures that inadvertent driving or displacement of a screw positioned in a staged position 122 does not occur. To accomplish this goal, upset portion 120 is positioned within the path of an outer wall 124 of sliding core 18. As the external force is applied, outer wall 124 engages upset portion 120 and forces arm portion 118 to deflect thereby allowing sliding core 18 to collapse within body 20.

[0031] Figures 5 and 6 depict a depth stop 125 to include a series of annular stepped surfaces 126 which are selectably engagable with a portion of sliding core 18. Depth stop 125 includes a lever 128 protruding through an

aperture 130 formed in body 20. Depth stop 125 is axially retained within body 20, but is free to rotate the arcuate distance defined by aperture 130. By rotating depth stop 125, stepped surfaces 126 rotate into and out of position for engagement with sliding core 18. Therefore, the travel of body 20 relative to sliding core 18 is limited by the position of depth stop 125. By limiting the travel of body 20 relative to sliding core 18, the fully extended position of bit 14 is defined. It is contemplated that the full range of adjustment varies 1/8". For example, a screw head may be counter-sunk 1/16" below a surface of the workpiece or may be positioned 1/8" below the plane of the work surface.

[0032] Sliding core 18 includes a first side 132 coupled to a second side 134 by a plurality of fasteners (not shown). Each of first and second sides 132 and 134 are preferably injection molded components in the shape of thin walled shells. As previously mentioned, sliding core 18 includes screw feed track 64 and bit bore 66. A toggle 140 of feeder mechanism 28 is biased toward the position depicted in Figure 7 by a torsional spring 142. Toggle 140 is rotatable about a pin 144. Toggle 140 includes a first corner 146, a second corner 148 and a leg 150. First corner 146 and second corner 148 are in communication with screw feed track 64. Toggle 140 functions to selectively allow the threaded fasteners to enter staged position 122 where the screw 16 is coaxially aligned with the axis of rotation of bit 14. A magnet assembly 152 is positioned within a pocket formed within sliding core 18 to attract the head of screw 16 and retain the screw in staged position 122. Magnet assembly 152 includes a magnet 153 and a ferromagnetic cup 154.

[0033] Sliding core 18 includes a window 155 to provide access to staged position 122 and a portion of screw feed track 64. A translucent access cover 156 is pivotally coupled to sliding core 18 to selectively close window 155. Each side 132 and 134 of sliding core 18 includes a socket 158 for receipt of a trunion 160 extending from access cover 156. Sliding core 18 includes a groove 162 aligned with a recess 164 formed in access cover 156. An elastic band 166 is selectively disposed within groove 162 and recess 164 to retain access cover 156 in a closed position. If an operator desires access to staged position 122 or screw feed track 64, elastic band 166 is partially or completely detached to allow opening of access cover 156.

[0034] Figures 7 - 10 depict screwfeeder 10 at various positions during the process of driving screw 16 into a workpiece. Specifically, Figure 7 depicts body 20 and sliding core 18 in a fully extended position. An exemplary screw 16a is shown located within screw accumulation tube 22 at a pre-staged position. In the pre-staged position, the head of screw 16a is engaged by second corner 148 of toggle 140. It should be appreciated that leg 150 of toggle 140 is clear of an outer surface 168 and an upper cam surface 170 of body 20 at this time. Torsional spring 142 biases toggle 140 in a counter-clockwise direction and loads a detent 172 of toggle 140 against a seat 174 of sliding core 18.

[0035] With reference to Figure 8, sliding core 18 and body 20 are located in the fully collapsed position. The extent to which core 18 is allowed to telescope within body 20 is limited by depth stop 125. One of annular stepped surfaces 126 contacts an end face 172 of sliding core 18 at the fully collapsed

position. At this time, bit 14 is fully extended and tip 114 protrudes from sliding core 18 and body 20. During relative movement of sliding core 18 and body 20, upper cam surface 170 engages leg 150 to rotate toggle 140 in a clockwise direction. Because the screws are being acted upon by gravity, screw 16a disengages second corner 148 and drops into engagement with first corner 146. The tip of a subsequent screw 16b engages the head of screw 16a.

[0036] Figure 9 depicts housing 20 and sliding core 18 moving from the collapsed position toward the extended position. During this movement, leg 150 disengages upper cam surface 170. Accordingly, toggle 140 rotates counter-clockwise to release screw 16a and capture screw 16b. Under the pull of magnet 152, the tip of screw 16a rides against sleeve 90 until it is retracted within bit bore 66.

[0037] Figure 10 shows sliding core 18 and body 20 positioned in the fully extended position. Sleeve 90 and return spring 92 are now clear of staged position 122. Therefore, magnet assembly 152 attracts screw 16a and orients it within bit bore 66. Screw 16a is now located within the staged position 122 where the screw's longitudinal axis is generally aligned with the rotational axis of bit 14. When an operator applies sufficient force to handle 44 and/or hand drill 12 to overcome detent spring 117, bit 14 engages screw 16a to simultaneously rotate and axially translate screw 16a into the workpiece. With a quantity of screws in the screw accumulation tube 22, the screw feeding and driving process may be rapidly repeated without requiring the operator to individually handle the screws or bend over from an upright or near-upright standing position.

[0038] Furthermore, the foregoing discussion discloses and describes merely exemplary embodiments of the present invention. One skilled in the art will readily recognize from such discussion, and from the accompanying drawings and claims, that various changes, modifications and variations may be made therein without department from the spirit and scope of the invention as defined in the following claims.